Small Business Innovation Research/Small Business Tech Transfer

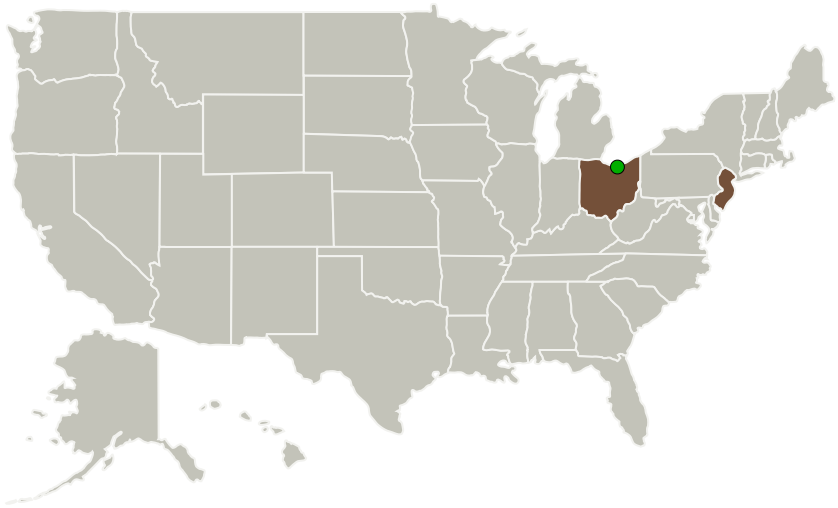
Silicon Carbide Gate Driver, Phase I

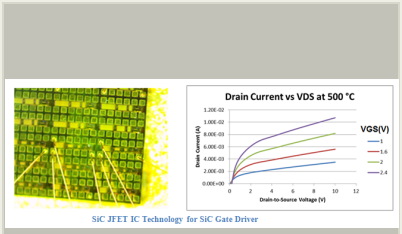
Completed Technology Project (2017 - 2017)

Project Introduction

NASA needs efficient, low mass, low volume power electronics for a wide variety of applications and missions. Silicon carbide (SiC) switches provide fast, low loss switching, low on-resistance and high breakdown voltage to potentially meet this need. Gate drivers are a key component to fully realize the system level advantages that SiC power switches can provide. By implementing gate drivers in SiC, they can tolerate extreme temperatures (500 deg. C) allowing them to be collocated with the power switches they control. This reduces parasitic inductance and circuit area improving the performance of the power switch and converter. The SiC gate driver will have direct near term application in power processing units and other NASA power conversion systems and also be suitable for future exploration missions in extreme environments. In Phase I, we will design and simulate the gate driver to show its feasibility. In Phase II, we will fabricate the gate drivers and demonstrate them operating at high temperature in a practical circuit such as a high voltage boost converter. We will also perform radiation testing on the gate driver to evaluate its radiation hardness as need for extended space operation. Following Phase II, we will integrate the gate driver with co-packaged SiC switches for NASA and commercial applications. Additionally, the advancement in TRL demonstrated by Phase II testing will help accelerate commercial availability of USCi's SiC integrated circuit fabrication service.

Primary U.S. Work Locations and Key Partners





Silicon Carbide Gate Driver, Phase I Briefing Chart Image

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Organizations Performing Work	Role	Type	Location
United Silicon Carbide, Inc.	Lead Organization	Industry	Monmouth Junction, New Jersey
Glenn Research Center(GRC)	Supporting Organization	NASA Center	Cleveland, Ohio

Primary U.S. Work Locations	
New Jersey	Ohio

Project Transitions

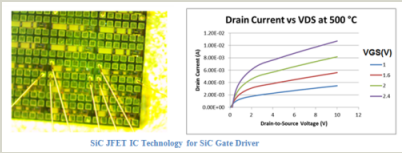
June 2017: Project Start

December 2017: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/140774)*

Images



Briefing Chart Image
Silicon Carbide Gate Driver, Phase I Briefing Chart Image *(https://techport.nasa.gov/image/128333)*

Organizational Responsibility

Responsible Mission Directorate:
Space Technology Mission Directorate (STMD)

Lead Organization:
United Silicon Carbide, Inc.

Responsible Program:
Small Business Innovation Research/Small Business Tech Transfer

Project Management

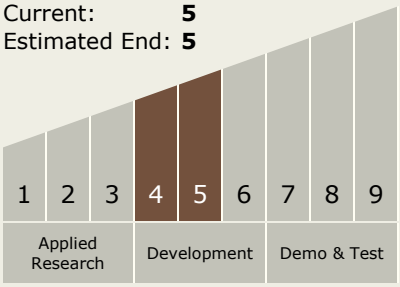
Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
Matthew O'grady

Technology Maturity (TRL)

Start: **4**
Current: **5**
Estimated End: **5**



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Technology Areas

Primary:

- TX03 Aerospace Power and Energy Storage
  - TX03.3 Power Management and Distribution
    - TX03.3.4 Advanced Electronic Parts

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System